

Artigo de revisão

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In search of treatments for striae rubra and striae alba: a dermatologists' challenge

Em busca dos tratamentos para Striae Rubra e Striae Alba: o desafio do dermatologista

RESUMO

A estria atrófica cutânea ou *striae distensae* (SD) é dermatose muito comum, constituindo causa frequente de consulta ao dermatologista. Devido a seu caráter inestético, pode trazer importantes consequências psicossociais e na qualidade de vida. O objetivo do trabalho foi revisar as possibilidades de tratamento preconizadas na literatura para estrias recentes e antigas. Diante da multiplicidade de fatores etiológicos envolvidos, a literatura é divergente e ampla sobre o tratamento.

Palavras-chave: estrias de distensão; terapêutica; terapia a laser.

ABSTRACT

Cutaneous atrophic striae (or striae distensae) is a very common skin condition that frequently motivates dermatological consultations. Due to its unaesthetic appearance, it can have a significant impact on patients' psychosocial status and quality of life. This study reviews the literature involving possible treatments for more recent and older cutaneous striae or stretch marks. Given the great number of etiological factors involved, the literature is abundant and divergent regarding the treatment of the condition.

Keywords: *striae distensae; therapeutics; laser therapy.*

INTRODUCTION

Atrophic cutaneous stria or striae distensae (SD) is a very common dermatosis and is a frequent reason for consultation with dermatologists. Due to its unsightly appearance, it can lead to significant psychosocial consequences and can have a negative impact on a patient's quality of life, especially for women.^{1,2} Its etiology remains uncertain, meaning its treatment is challenging.^{3,4}

The incidence of striae distensae is described in the literature as occurring at rates of 40-70% during puberty and at 70-90% during pregnancy.⁵⁻⁷ It appears predominantly on the arms, hips, abdomen and lumbosacral region, though it can affect other body sites when linked to Cushing's syndrome or to the use of exogenous corticosteroids.^{2,8}

Also referred to as stretch marks, striae distensae are composed of linear atrophic plaques, usually soft and depressible, and

are associated with the stretching of the skin. Their clinical appearance varies with their development stage: initially linear, erythematous to violaceous and edematous (striae rubra or recent), they become white, pale, atrophic, and deep with time. The direction of the striae corresponds to the tension lines of the skin, and their histology follows this developmental characteristic. An inflamed appearance is typical at the outset of the condition, with dermal edema and perivascular lymphocytic infiltrate, which later develops into atrophy of the epidermis, the reduction of epidermal ridges, and loss of skin appendages. In the area of the striae, it is possible to observe an increase of glycosaminoglycans, in addition to verticalization collagen fibers adjacent to the dermal-epidermal junction, and a significant reduction of elastic fibers in the papillary dermis. With ultrastructural analysis, the striae's dermal matrix appears diminished and with floccular texture.^{9,10}

SD occurs in a number of physiological and pathological situations (such as pregnancy, adolescent growth spurts, obesity, rapid loss or gain of weight), and states of cachexia (such as tuberculosis), anorexia nervosa, and after strenuous diets. It is also associated with the use of medications, such as protease inhibitors (indinavir) in patients with HIV, as well as with chronic liver disease and adrenal hormonal alterations (such as hypercortisolism) and use of exogenous steroids. Genetic predisposition also plays a role, with greater frequency in monozygotic twins, and individuals with genetic syndromes such as Ehlers-Danlos' and Marfan's.^{11, 2, 12}

SD's etiology remains controversial, with local and systemic pathological factors described as having an impact on alterations in the connective tissue. There are reports of alterations in the quantity, quality, and configuration of elastic fibers, collagen, and fibrillin in the dermis, leading to the loss or rupture of elastic fibers in the affected region due to the skin's mechanical condition of stretching or strain. Like Rosenthal, other authors describe four mechanisms involved: insufficient development of integument, including impairment of elastic properties, fast stretching of the skin, endocrine and other – possibly toxic – alterations.^{3,13}

Given the multiplicity of etiologic factors involved, the literature is wide in scope and divergent regarding its treatment. As a result, numerous options have been proposed, with some practitioners suggesting the use of more than one consistently effective treatment, and others recommending just one isolated and sufficient therapy.

OBJECTIVE

The present study's objective was to review the treatment options recommended in the literature for treating recently formed as well as older stretch marks.

METHODS

The authors researched and selected academic papers during the period from June to October 2011. The literature review was carried out using the PubMed, Cochrane, and Lilacs databases, in the English, Portuguese, and Spanish languages. The

researched keywords were: striae distensae, stretch marks, estrias cutâneas. Cross-references that were researched included: treatment/tratamento, laser, radiofrequency/radiofrequência, peeling, retinoic acid/ácido retinóico and microdermabrasion/microdermabrasão. Additional research strategies were: examining the selected articles' references and a manual search of leading dermatologic journals.

Criteria for the selection of studies:

One hundred forty-two articles about striae distensae were found on PubMed,⁷ on Cochrane, and 1 on Lilacs. Seventy-three of them analyzed treatment methods.

Methodologic quality:

The selected studies' methodologic quality was assessed according to the following criteria: adequate randomization, use of a control group, clearly described inclusion and exclusion criteria regarding the study population, proper and clearly described technique, and use of histological methods for comparison and evaluation. A special focus was put on studies based on controlled clinical trials, meta-analysis, reviews, and randomized trials.

RESULTS

For didactic purposes, the treatment modalities were itemized into: diet and exercise, topical medications (retinoic acid, moisturizing creams, glycolic acid, ascorbic acid and chemical peels), combination therapy UVB/UVA1, lasers, microdermabrasion, radiofrequency, and intradermotherapy.

Diet and exercise

There are few studies in the literature about the correlation between SD, diet, and physical exercise. Schwingel et al. conducted a study monitoring 80 obese women,²⁴⁻⁵³ years of age, with SD who followed a weight loss program for three months. The volunteers were divided into three groups: twenty-nine followed a diet only,³¹ followed a diet and practiced aerobic exercise, and 20 followed a diet and an endurance exercise program. There was no statistical difference between the degree of weight loss and the improvement of SD, when this type of program was followed.¹⁴

Topical treatments

Tretinoin

Tretinoin is a well-established therapeutic modality for treating acne and photoaging conditions. It is believed to cause fibroblast stimulation and increased collagen production and angiogenesis in SD, however these results are still controversial. Most of the published articles describing its use refer to patients with pregnancy-related striae.¹⁵

In 1994, Pribanich et al. conducted a double-blind, placebo-controlled trial, which demonstrated the ineffectiveness of 0.025% tretinoin for seven months in the treatment of striae rubra related to pregnancy. However, several studies correlate a better appearance and reduced width of pregnancy striae with

the use of tretinoin. In a 1996 article, it was histologically demonstrated that the use of tretinoin improved the clinical appearance of stretch marks during the active phase (striae rubra) – though with little effect during the mature stage (striae alba). That study evaluated 22 patients who used 0.1% tretinoin ($n = 10$) versus placebo ($n = 12$) daily, for six months in the affected areas. Clinical and histological results (pre-and post-treatment) demonstrated decreases of 14% in the length and of 8% in the width of striae rubra in patients who used tretinoin as compared with an increase of 10% in length and of 24% in width in patients who received placebo. 15, 16 In 2001, through an open multi-centric study, Rangel et al. showed that 0.1% tretinoin cream applied daily on one side of the abdominal region of women with pregnancy-related striae, led to a clinical decrease of 20% in length and 23% in width, as compared with striae on the other side, where the placebo was applied. 16

A study comparing 20% of topical glycolic acid and 0.05% of tretinoin versus 20% of glycolic acid and 10% of L-ascorbic acid in women between 23–49 years of age, with striae alba, demonstrated that both doses can improve the appearance of SD, without significant statistical differences. 17

In 2002, Garcia showed that the improvement in the appearance of stretch marks following the use of topical 0.1% tretinoin remained for about one year after the end of the therapy. 18

Moisturizing creams

Specific moisturizing treatments are numerous and unproven. Despite the consensus that proper hydration is necessary to maintain the skin barrier's integrity and function, there is little literature available on the use of creams for the prevention and treatment of striae. The lack of clarity on the available data and scientific studies makes it difficult to make conclusions about the effectiveness of creams. In addition, more thorough studies are necessary in order to determine the efficacy and safety of these products in the treatment of stretch marks. Studies found in the literature are, in general, sponsored by the companies that have developed them. 19

A study involving 80 women was aimed at investigating the effect of massage with a cream containing Asian Centella extract, vitamin E, and collagen-elastin hydrolysates (Trofolastin®, Novartis, Barcelona, Spain) in the prevention of stretch marks in pregnant women. Forty-one volunteers used the cream, and 39 used a placebo. The results showed that 56% of placebo patients and 34% of the effectively treated group developed SD during pregnancy. That study demonstrated that the active component in Asian Centella induced significant prevention of the development of stretch marks. The mechanism of action was precisely identified as being the stimulation of fibroblast activity. In addition, a defensive effect against glucocorticoids was also reported. 19

Another study with 50 women (without a placebo control), examined a cream containing vitamin E, panthenol, hyaluronic acid, elastin, and menthol (Verum®). The treatment was associated with fewer SD during pregnancy. A third of women

in the treated group and two thirds of those who received no treatment developed stretch marks during pregnancy. Even though the study did not involve a placebo and the benefits of isolated massage have not been evaluated, the results suggest that the product might be useful. 19

Alphastris® is a cream composed of hyaluronic acid, allantoin, vitamin A, vitamin E, and dexpanthenol. Hyaluronic acid is a major constituent responsible for stimulating the activity of fibroblasts and the production of collagen. Only one study showed its efficacy and safety: thirty pregnant women used the cream, while a placebo was given to a control group of equal size. In the group that used the cream, only three women developed SD, compared to 21 in the placebo group. The study concluded that the incidence of striae was reduced with the use of topical cream, and that better results were found in those with less tendency to gain weight. 20

The preventive application of oil or water-based massage creams was tested on a group of 24 pregnant women (control group = 26 patients). In the untreated control group, the SD were observed in two thirds of patients, whereas in the treated group, the SD developed in only one third of the volunteers. 21

Glycolic acid (GA) and trichloroacetic acid (TCA)

GA is an alpha-hydroxy acid widely used in various dermatological conditions, although few studies in the literature demonstrate its use in SD. There is a lack of epidemiological studies on the use of GA in pregnant women. As previously mentioned, the topical use of 20% GA, and 0.05% tretinoin as compared with 20% AG and 10% L-ascorbic acid were equally effective, with no significant differences. 17

TCA (10–35%) has been used for many years and is safe for use in low concentrations. At higher concentrations (e.g. 50%) it presents a trend to produce scarring and is less manageable than other agents used for superficial peelings. Further studies are necessary to better understand the subject. Some authors have had success with TCA in low concentrations (15–20%) in the papillary dermis, and with carrying out chemexfoliation sessions at monthly intervals with reported improvement in the texture and color of striae. 4

Peelings

In spite of the use of retinoic acid being considerably popular in dermatological practice as an adjuvant therapy and for treating other dermatoses, there is a lack of information in the literature about its use as a peeling treatment for SD.

Laser and Pulsed Dye Laser (PDL) based technologies

The 585nm flashlamp-pumped pulsed dye laser is one of the most well established lasers for treating SD, particularly striae rubra. It has a non-ablative approach, which operates in dilated blood vessels, increasing the level of extracellular matrix collagen. In 1996, McDaniel et al. showed optimal fluency in the 3 J/cm² band, using a 10mm spot, compared to a placebo and other fluencies ranging from 2.0 to 4.0 J/cm² and spot sizes of 7 to 10mm. 22 In 2003, Jimenez et al. demonstrated improvement

in SD ranging from pink to erythematous – as compared with striae alba – and even with biopsies, showing increased collagen, even at a stage not clinically evident. Due to the fact that, as chromospheres, melanin competes with hemoglobin for the energy radiation of the 585nm laser, many authors do not recommend the use of this laser for patients with skin type IV to VI, given the risk of post-inflammatory hyperpigmentation.²³ In 2007, Suh et al. demonstrated improved clinical appearance of SD and elasticity in patients with striae alba who underwent sessions of associated RF and 585nm pulsed dye laser in patients with Fitzpatrick skin type III and VI (with only one of the 37 patients having post-inflammatory hyperpigmentation, which resolved spontaneously after 12 weeks).²⁴ In 1999, Nouri used pulsed dye laser and short pulse CO₂ laser and placebo in three body sites, in a study of four patients with abdominal striae alba (two phototype IV patients and two phototype VI patients). None of the treatments was satisfactory, with no improvement of striae, and even a result of post-inflammatory hyperpigmentation in two phototype VI patients, when using the two types of laser. In one phototype IV patient, the laser also caused persistent erythema, still observed after 20 weeks of follow up.²⁵

Copper Bromide Laser

Copper bromide laser is a 577nm non-ablative laser described in the literature only for treatment of SD. A study with 15 phototype I to III patients who underwent 4 J/cm² laser on SD on the breast region and 8 J/cm² in other body sites, demonstrated effectiveness in reducing the striae's size.^{26,4}

1,450 nm Diode Laser

1,450 nm diode laser is a non-ablative, infrared light-based laser with an integrated cooling unit, which exerts controlled thermal damage leading to the subsequent production of collagen and remodeling of the extracellular matrix, thus preserving the epidermis and leading to the clinical improvement of rhytides and scars. In 2003, Tay et al. conducted a study with 15 patients with striae alba (9) and striae rubra (2), in Fitzpatrick phototypes II and III, using biopsies before and after the treatment and a double-blind photographic analysis. The laser did not offer efficacy in treating hyperpigmentation, in addition to causing intense post-inflammatory hyperpigmentation.^{4,27}

1,064nm Nd:YAG (Neodymium-Doped Yttrium Aluminium Garnet) Laser

1,064nm Nd:YAG is a non-ablative infrared light-based laser, which acts primarily on melanin and hemoglobin. It can be used to treat recent striae or striae rubra safely, even in higher phototypes, as it has been linked with increased levels of dermal collagen. By acting especially on blood vessels, it ensures beneficial effects on the appearance of striae rubra, yet limited (though still positive) effects on the atrophic appearance of lesions. In 2008, Goldman described a study with 20 patients bearing striae rubra who underwent Nd:YAG, based on photographic analysis. Both the investigator and patients reported improvement in 40% and 55% of cases, respectively.^{4,28,29}

Intense Pulsed Light (IPL)

IPL is characterized by the emission of non-coherent, pulsed, and broad spectrum light, ranging from visible light to infrared (400 to 1,200nm). It is regarded as the first line option in vascular lesions, and can also be used for treating SD. Hernandez et al. studied abdominal striae alba in 20 Fitzpatrick skin types III and IV patients. After 5 treatment sessions, and pre- and post-treatment biopsies, there was an increase in dermal thickness and an improvement in the texture of lesions in all cases. Studies have shown that there is a replacement of dermal elastolysis with neocollagenesis, improving the striae's appearance.¹¹

UVA / UVB1 combined therapy

This method is carried out with an appliance that combines UVB and selective UVA1, emitting high-intensity light, which is not coherent with 313nm, 360nm and 420nm peaks. In a study of nine patients with striae alba who underwent 10 treatment sessions and pre- and post-treatment biopsies, and where there was histologic alteration regarding the remodeling of collagen, there was transient repigmentation without the compromise of perilesional tissue. Further studies are necessary to assess the efficacy and side effects.^{11,4}

1,550nm Erbium Glass Laser

1,550nm Erbium Glass Laser is a non-ablative, fractional resurfacing laser that uses 1,550nm wavelength, creating micro-zones or microthermal zones (MTZs) of injury in the skin (containing localized epidermal necrosis and collagen denaturation), which are later expelled, giving rise to the neocollagenesis. It simultaneously maintains areas of normal skin, accelerating the healing process. There are few studies on its use in SD.³⁰

In 2008, a Korean study with 6 patients demonstrated significant clinical improvement after 8 weeks of treatment. Histologic analysis showed a significant increase in epidermal thickness, which became close to that of areas without striae, and in addition there was a substantial increase in elastic fibers after 8 weeks. Discrete hyperpigmentation was observed and resolved 8 weeks after the treatment.³¹

In 2009, in a study of 22 women with white striae who underwent 2 sessions in 4-week intervals, Hana Bak et al. demonstrated that 6 of the patients showed good to excellent improvement (27%). The other 16 (63%) had mixed results, as compared to the histological analysis of the dermis' and epidermis' thickness before and after 1 month of treatment. Side effects were not reported.³²

In yet another Korean study, published in 2011 and including 22 patients, 1,550nm Erbium Glass laser and fractional CO₂ laser were compared, with all patients undergoing both treatments – one in each half of the abdomen. Three sessions were carried out in 4-week intervals. The study suggested physician-evaluated clinical improvement, and patient satisfaction, which were statistically similar in both methods. Histologically, there was an increase of the mean thickness of epidermis (slightly greater with CO₂ laser), with the amounts of collagen and

elastic fibers significantly increased after the treatment with both lasers. The treatment was well tolerated. There were no long-lasting, significant adverse effects, except for mild and transient erythema and pigmentation. The fractional CO₂ laser-based treatment was considered more painful.³³

Ablative Fractional CO₂ Laser (10,600nm)

The ablative fractional CO₂ laser works by having water as its main target, resulting in tissular damage through thermal treatment and vaporization of cells, stimulating neocollagenesis. It has recently been adopted as a treatment of rhytids, facial rejuvenation, and acne scars. There are few articles in the literature regarding its use in SD.

Alexiades-Armenakas et al. have recently analyzed the use of CO₂ in different cutaneous modalities – among them striae alba – in five patients who underwent three or four monthly application sessions. The clinical results were inconclusive –

Three patients had no improvement, 1 had improvement considered good (3 on a scale of 4) and 1 had moderate improvement (2 on a scale of 4) – thus the results of this treatment have been deemed inconsistent and unpredictable.³⁴

In another study, Lee et al. analyzed 27 patients treated with a single session of fractional CO₂ laser (10,600nm), demonstrating the following clinical outcomes three months after the treatment: two of 27 participants (7.4%) had a Grade 4 improvement, 14 (51.9%) had a Grade 3 improvement, nine (33.3%) had a Grade 2 improvement, and two (7.4%) had a Grade 1 improvement. None of the participants experienced a worsening of the condition according to this improvement scale, where 0 = worsened, 1 = minimal improvement or steady state (0-25%), 2 = moderate improvement (26-50%), 3 = considerable improvement (51-75%), 4 = almost complete improvement (75-100%). The average score of clinical improvement was 2.6. Research into overall patient satisfaction after the treatment suggested that six of 27 participants (22.2%) were very satisfied, 14 (51.9%) were satisfied, five (18.1%) were slightly satisfied, and two (7.4%) were dissatisfied.³⁵

In 1999 Nouri compared the use of 585nm pulsed dye laser with CO₂ laser in the treatment of striae in Fitzpatrick skin type IV to VI patients. In all cases there was no improvement, but side effects ranging from persistent erythema to hyperpigmentation did occur, indicating that for patients with these skin types, laser-based treatment should be avoided.²⁵

Microdermabrasion

Microdermabrasion is a procedure that has been used in certain skin conditions, such as acne scarring, mottled pigmentation, and fine rhytids. There are reports of induction of epider-

mal transduction signals, typically associated with the remodeling of the dermal matrix. However, this technique is not approved by the FDA, and there is no evidence available from double-blind studies of controlled trials.

Radiofrequency

Radiofrequency produces electricity that heats the dermis, resulting in the moderate shrinkage of collagen, in turn inducing the formation of new collagen. According to some authors, this is a non-invasive and effective technique. Its use in SD was reported in association with 585nm pulsed dye laser in 37 patients by DongHye by Suh et al. in 2007. Nine patients underwent three PDL sessions, the first combined with radiofrequency. Histological analysis demonstrates increased collagen fibers in all patients, and increased collagen and elastic fibers in six of them.^{24,4}

CONCLUSION

In the face of the multiplicity of etiologic factors involved, the literature on the treatment of SD is wide and divergent. Numerous treatments have been proposed and while several were reported as consistently effective, no one single therapy modality was described as being completely efficient on its own.

The studies suggested the importance of preventing the emergence of stretch marks, especially during pregnancy. Such prevention can be accomplished with the use of moisturizing creams containing hyaluronic acid or Asian Centella.

0.1% tretinoin as well as 20% glycolic acid associated to 0.05% tretinoin or 10% of L-ascorbic acid can be used as topical treatments to improve the clinical condition of SD during its active development phase (striae rubra).

Regarding laser based treatments:

Pulsed dye laser (PDL) was demonstrated to improve SD – with appearance ranging from pink to erythematous, as compared to striae alba. This laser is not recommended for patients with Fitzpatrick skin types IV to VI, due to the risk of post-inflammatory hyperpigmentation.

Copper bromide laser has increasingly been shown to be effective in reducing the size of striae.

Nd:YAG was the subject of a study in which improvement in striae rubra was evidenced in 40-55% of cases.

Intense pulsed light (IPL) was shown in several studies to cause the replacement of dermal elastolysis with neocollagenesis, improving the appearance of stretch marks.

Fractional photothermolysis has led to improvements in texture and appearance of old stretch marks. Good to excellent improvement was reported in 27% of cases. ●

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